

Association between Hamstring Flexibility and Sprint Speed after 8 Weeks of Yoga in Male Rugby Players

Abstract

Background: A Yoga-asana-based intervention has demonstrated its ability to improve flexibility of individuals, but has not been explored in rugby players. We hypothesized that a structured yoga intervention may have an effect on flexibility and sprint performance in male rugby union players. **Methods:** It was a controlled trial research design and players were assigned using random sampling to one of the two groups; a yoga group ($n = 16$) that practised yoga for 1 h 2 times a week for 8 weeks in addition to their normal rugby training and a control group ($n = 15$) with regular rugby training but no yoga intervention. Yoga intervention included 32 yoga postures to address both the upper and lower extremities of the body. Data were collected during preseason and mid-season on hamstring flexibility (sit and reach test), and sprint performance (measured at 5, 10, and 30 m). **Results:** One hundred and twenty participants were screened and thirty-one players volunteered for the study. Interactions between groups and differences between pre- and post-intervention scores were analyzed using analysis of variance using SPSS (version 24.0). Significance was set at an alpha level of $P \leq 0.05$. The yoga group showed a small nonsignificant decrease ($-1.2\% \pm 21.4\%$, $P = 0.05$) in hamstring flexibility compared to the control group which demonstrated a large significant decrease ($-14.8\% \pm 23.7\%$) (mean % change \pm 95% confidence interval [CI], $P < 0.05$). The yoga group also showed minor nonsignificant improvements in sprint times $-3.2\% \pm 10.4\%$, $-0.7\% \pm 9.0\%$ for the 5 and 10 m sprints, respectively, (mean % change \pm 95% CI) compared to controls $-0.4\% \pm 10.2\%$, $0.4\% \pm 7.9\%$. **Conclusions:** Findings suggest that completing a structured yoga intervention alongside normal rugby training during the rugby season, yoga helped rugby players maintain their hamstring flexibility but did little to improve sprint performance during the season.

Keywords: Acceleration, performance, range of motion, stretching

Introduction

Flexibility is a vital factor that has been associated with improved performance^[1] and reduced sports-related injuries.^[2] Many coaches, physicians, and trainers have accepted the important role flexibility plays in sports and have included exercises to increase and maintain flexibility in warm-up sessions before sports activity.^[1] However, researchers have reported mixed results when examining the effects of flexibility on speed, athletic performance, and countermovement jump performance.^[1,3-6] These mixed results have created confusion and debate among researchers, particularly around the association stretching has with subsequent explosive performance.^[4,7-9] To date, only a few researchers have explored the chronic effect of a stretching routine or flexibility intervention on rugby players.^[10]

Yoga is a combination of physical postures (Asana), breathing exercises (Pranayama), and meditation (Dhyana), which focuses on the physical and mental aspects of an individuals' movements.^[11] Improved flexibility is one of the major benefits of yoga practice and yoga has been shown to have similar effects compared to stretching exercises.^[12] This study employed Hatha-yoga, which uses various body positions to stretch muscles in conjunction with an emphasis on controlled breathing exercises.

The aim of the study was, therefore, to assess whether a yoga (stretching) intervention practised by male rugby players alongside their usual rugby training had any effect on their subsequent flexibility and sprint performance.

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Methods

Participants

Initially, 120 players were screened, and 31 male rugby players (19.5 ± 0.9 years) [Table 1] from a local rugby union football club volunteered for the study [Figure 1]. However, only nineteen players (yoga $n = 12$) (control $n = 7$) completed the study due to injuries and personal circumstances. All players were novices to the practice of yoga. Players were randomly assigned either to the yoga group (practised yoga for 1 h, two times/week for 8 weeks in addition to their normal rugby training) or the control group (continued with their normal rugby training without yoga). All players were free from any current or previous injuries. All players were also informed about the possible risks of volunteering for this study and provided written informed consent before the study. Following the

Table 1: Physical characteristics and playing experience of the yoga and control groups

Group	Yoga group	Control group
Age (years)	19.1±0.9	19.6±0.9
Height (cm)	181.3±8.1	182.7±4.1
Weight (kg)	88.9±18.7	85.5±9.4
BMI (/m ²)	26.6±5	26.6±3.3
Rugby experience (years)	4.0±1.3	3.5±1.3

Data are mean±SD. SD: Standard deviation

Declaration of Helsinki, this research was approved by the Institutional Human Ethics Committee.

Design of the study

A yoga intervention was exclusively designed for rugby players and delivered by a yoga instructor (registered exercise professional, New Zealand). Players were required to complete 3, 30 m sprints to measure the physical performance. All participants were in the same yoga class, and all sessions were completed in a large open fitness room.

Assessment

Flexibility of the hamstrings

A baseline examination was carried out 1–2 weeks before the yoga intervention and again 1–2 weeks after the last yoga session. The hamstring flexibility of players was measured in a seated position in front of a Flex-Tester[®] box (Novel Products, Inc.; Rockton, IL, USA). The hamstring flexibility test consisted of 3 sit-and-reach tests. Players were not allowed to flex their knees during the test and players were required to have a 2 min rest between each attempt with the best attempt used in the analysis.

Sprint performance

After completing the hamstring flexibility test, sprint performance was measured using three 30-m sprints. The

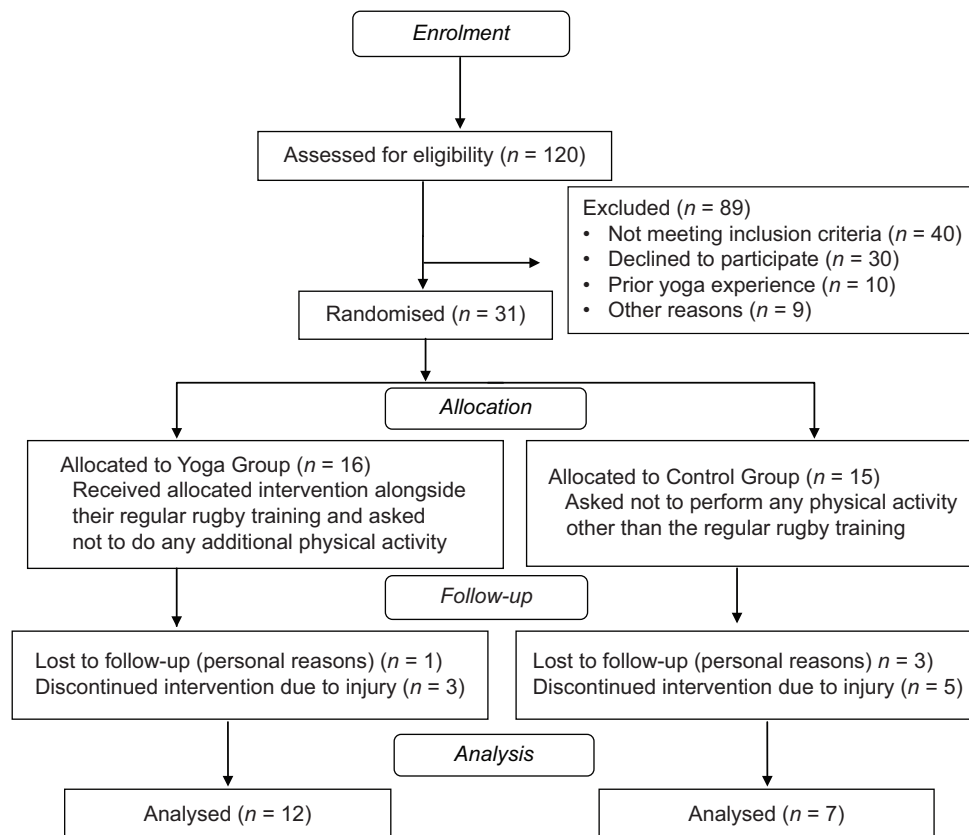


Figure 1: Flowchart describing the selection and categorisation of subjects from the rugby clubs for the present analysis

sprint was analyzed in two acceleration phases (5 and 10 m) and maximal velocity (30 m).^[13] Each participant completed the sprint from a standing start position. Sprint time (to the nearest 0.01 s) was recorded using a set of electronic speed-timing lights placed at 5, 10, and 30 m (SmartSpeed, Fusion Sport Ltd., Australia). A 2 min recovery was required between each sprint, and the best of 3 attempts was used in the analysis. All players were asked not to perform any strenuous exercise in the 24 h before testing. The testing was completed at the same time of day on a large covered slip-free floor area under similar climatic conditions.

Intervention

Yoga classes were offered two times a week for 8 weeks, which started at the beginning of the rugby season. The average attendance rate for the yoga group was 75% (12 sessions), with some players attending all (16) sessions, whereas others only attended (9) sessions. Each yoga session consisted of a warm-up of 10 min with Surya-namaskar (dynamic stretching sequence of postures) followed by 35 min of yoga postures (10 min standing, 10 min sitting, and 15 min of supine and prone postures and a mix of static and dynamic postures) and 10 min relaxation in the final resting position (lying in the supine position without any stretching exercise). A total of 5 min was allocated for the transition between the yoga postures.

Data extraction

The mean of the fastest sprint time and highest flexibility scores of individual players at pre- and post-testing were recorded on Excel and later were used in the group analyses.

Data analysis

The number of participants required for the study was calculated using a spreadsheet with the smallest worthwhile change in performance being 1.0% and the typical error or within-subject standard deviation (SD) in similar tests of 0.7%. This calculation estimated we needed 7 participants in each group in a controlled trial research design. Interactions between group and differences between pre- and post-intervention scores were analyzed using analysis of variance. Statistical analyses were performed using SPSS 24 for Windows (SPSS, Inc., Chicago, IL,

USA). Significance was set at an alpha level of $P \leq 0.05$. Data given represents the mean \pm SD unless stated otherwise.

Results

The yoga group showed a small decrease ($-1.2\% \pm 21.4\%$) in hamstring flexibility compared to the control group which demonstrated a significant decrease ($-14.8\% \pm 23.7\%$) (mean % change \pm 95% confidence interval [CI], $P < 0.05$). In addition, the yoga group showed a small, but nonsignificant improvement of $3.2\% \pm 10.4$, and $-0.7\% \pm 9.0\%$, in their sprint time when compared to the control group $-0.4\% \pm 10.2\%$, $0.0\% \pm 7.9\%$, in 5 and 10 m, respectively [Table 2].

Discussion

This study found that rugby players that undertook 8 weeks of static and dynamic stretching during a weekly 1-h yoga intervention, in addition to their normal rugby training sessions, either maintained or had a minimal decrease in their hamstring flexibility compared to players who did the rugby training only. However, this flexibility training through the yoga intervention did little to improve short sprint performance between the groups (e.g., 5, 10, and 30-m sprint time), we found no significant beneficial improvement in sprint performance in the experimental group (receiving yoga intervention) compared to controls.

The controversial issue of stretching to improve performance is based on several postulated mechanisms. Dynamic movement requires the contraction and elongation of the muscle-tendon unit (and thereby, movement of the limb around the joint). This shortening and stretching (stretch-shortening cycle), relies on the elastic properties of the tendon to enable the release of potential energy. Hence, the elastic property of the muscle-tendon unit is crucial and is influenced by the stiffness of both tissues. It is believed that greater compliance (i.e., less stiffness) in these tissues improves energy storage, thereby enhancing muscle performance.^[14] Given that the stretching (yoga) group improved flexibility, compared to the control group, which may have increased muscle compliance, this did not seem to change muscle performance during sprinting in the rugby players measured in this study. This suggests that either tissue compliance did not change (and the relative

Table 2: Hamstring flexibility and 5, 10, 30 m sprint time of the yoga and control group

	Control group			Yoga group			Between group pre post (% change (\pm 95% CI))
	Pre (n=7)	Post (n=7)	Control group pre post (% change (\pm 95% CI))	Pre (n=12)	Post (n=12)	Yoga group pre post (% change (\pm 95% CI))	
Flexibility (cm)	32.3 \pm 9.4	26.0 \pm 12.9	-14.8 (23.7)	31.1 \pm 11.1	30.9 \pm 9.4	-1.2 (21.4)	17.3 (30.8)*
5 m Sprint (s)	1.01 \pm 0.07	1.01 \pm 0.15	-0.42 (10.21)	1.07 \pm 0.05	1.04 \pm 0.14	-3.2 (10.4)	-2.7 (10.4)
10 m Sprint (s)	1.78 \pm 0.11	1.80 \pm 0.23	0.37 (7.85)	1.82 \pm 0.14	1.81 \pm 0.20	-0.7 (9.0)	-1.1 (8.4)
30 m Sprint (s)	4.35 \pm 0.27	4.57 \pm 0.60	4.37 (7.13)	4.52 \pm 0.31	4.54 \pm 0.40	0.2 (5.4)	-4.1 (6.7)

Data are raw mean \pm SD of each group with the difference within and between groups given as the percent mean difference \pm 95% CI.

*Statically significantly ($P < 0.05$). SD: Standard deviation, CI; Confidence interval

increase in flexibility is due to other mechanisms), or that there is little effect of increased compliance on sprint performance. On the other hand, while the yoga group showed an increase in flexibility compared to the control group (an average of 17.3%), in reality, the significant change between groups is probably because the flexibility in the control group decreased (−14.8%) while the flexibility in the yoga group changed little (−1.2%). Therefore, if the flexibility did not change in the yoga group, we would not expect to find greater muscular compliance and thus little change in performance.

Previous research has found that yoga practiced for 75 min two times/week for 20 weeks (average of 150 min/week) improved sit and reach scores by approximately 13 cm in the first 10 weeks and 17 cm at the end of training in healthy adults.^[15] The players in the current study completed approximately 90 min/week for 8 weeks which may indicate a larger stretching dose is required to achieve significant flexibility changes. In addition, not all players in the current study made every yoga session with an attendance rate of only 60% compared to 78% in the Petric's^[15] study. Overall, this would suggest the players in the current study received substantially less muscle stretching time which resulted in a lower stretching dose and therefore less muscle adaptation. We would recommend that any future studies in this area should allow players to complete at least 150 min of yoga per week. Whether the 150 min per week of muscle stretching (for a minimum of 12 and up to 20 weeks) can successfully be incorporated into shorter sessions (e.g. 30 min on 5 days/week) requires further investigation.

It is also possible, that due to muscle damage suffered either at training or during a match, which can result in substantial swelling and edema,^[16] the effectiveness of any chronic stretching intervention, was reduced. We speculate that perhaps the stretching employed in the current study by the yoga group was enough to buffer any losses in sprint performance associated with such muscle damage since the yoga group sprint times did not decrease as much as the control group sprint times. However, this is speculative and would require further research before this theory can be confirmed.

Conclusions

Yoga practiced for 1 h twice a week over an 8-week period was sufficient enough to maintain hamstring flexibility in male rugby players compared to players that did not complete yoga; however, the maintenance of flexibility did not result in any significant improvement in sprint performance in these players. We would recommend that any stretching intervention (including yoga) should be practiced for at least 150 min/week over a longer period (i.e., 20 weeks) to allow adaptations to occur which may result in muscular performance change.

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Conflicts of interest

There are no conflicts of interest.

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